

TITLE OF THE INVENTION

APPARATUS AND METHOD FOR PICTURE TRANSMISSION AND
DISPLAY

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of priority from the prior Japanese Patent Application No. 2000-301519, filed on Sept. 29, 2000; the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an apparatus and a method for transmitting a plurality of still pictures, and more particularly for transmitting and displaying still pictures in a predetermined sequence corresponding to special event, such as a scene change, for example.

Discussion of the Background

Digitalization of pictures is rapidly proceeding as evidenced by the increasing number of sold digital video recorders (DVR), which store pictures taken by an individual in a digital form. Further, digital broadcasting of information (e.g., TV channels) using Communication Satellites (CS) and Broadcasting Satellites (BS) is becoming more and more popular.

In addition, the Internet is currently used to distribute digital pictures. For example, it is now possible to download a short movie, etc. in real-time using a streaming technology existing on the World Wide Web (WWW). With the increased use of digitalized pictures, it has become important for a user to be able to select a particular desired portion of the digitalized picture stream without having to view the entire stream.

A search method, in which typical thumbnail pictures of sections are displayed allowing the user to select a desired thumbnail picture, is disclosed in the publication "Report by a study meeting of Information Processing Society of Japan, HI92-7, pp. 37-42, "GUI for

picture media using a picture analysis technology.” Thus, the user can search for a desired thumbnail picture without viewing the entire stream of pictures.

Further, the digital picture stream transmitted by broadcasting via the or Internet is frequently compressed in a MPEG (Moving Picture Experts Group) technology so as to reduce the data size. Note, a thumbnail picture is obtained by compressing a still picture.

However, compressed MPEG data is difficult to deal with in certain features such as quick feeding and rewinding processes, for example. Therefore, it is difficult to produce the user’s selected thumbnail by quick feeding or rewinding processes.

SUMMARY OF THE PRESENT INVENTION

Accordingly, one object of the present invention is to solve the above-noted and other problems.

Another object of the present invention is to provide a novel method and apparatus for transmitting thumbnail pictures extracted from a picture stream to an external apparatus in which the thumbnail pictures are transmitted in a predetermined sequence independent of the frame sequence number.

To accomplish these and other objects, the present invention provide a novel apparatus, method and computer program product for transmitting still pictures extracted from a picture stream. The apparatus includes a transmission request receiving unit for receiving a transmission request for the still pictures, and a transmission sequence determining unit for determining a transmission sequence for the still pictures which is different than the sequence of the still pictures in the picture stream. Also included is a transmission unit for transmitting the still pictures according to the determined transmission sequence.

Also provided is a display apparatus, method and computer program product for displaying a plurality of still pictures extracted from a picture stream is also provided. The display apparatus includes a still picture receiving unit for receiving a table having values corresponding to a sequence of the still pictures included in the picture stream, and for receiving any still pictures transmitted from an external apparatus. A still picture memory unit is coupled to the receiving unit, and stores the table and any received still pictures. In addition, a still picture control unit is coupled to the memory unit, and reads the table and determines whether or not a still picture corresponding to a first value in the table is stored in

the memory unit, and if the still picture is not stored in the memory unit, select another still picture that is saved in the memory unit and is closest in sequence to the still picture. A display unit displays the still pictures selected by the control unit.

BRIEF DESCRIPTION OF THE DRAWINGS

5 A more complete appreciation of the present invention and many of the attendant advantages thereof is readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

10 Fig. 1 is a block diagram showing a structure of a thumbnail picture transmission apparatus according to a first embodiment of the present invention;

Fig. 2 is a flowchart for explaining an operation of the thumbnail picture transmission apparatus according to the first embodiment of the present invention;

Fig. 3 is a diagram for explaining a picture stream used in the thumbnail picture transmission apparatus according to the first embodiment of the present invention;

15 Fig. 4 is a diagram showing thumbnail pictures extracted from the picture stream of Fig. 3;

Fig. 5 is a diagram for explaining a transmission sequence of the thumbnail pictures according to the first embodiment;

20 Fig. 6 is a diagram showing an example of a table produced and transmitted in the first embodiment;

Fig. 7 is a block diagram showing a structure of a thumbnail picture transmission apparatus according to a second embodiment of the present invention;

Fig. 8 is a flowchart for explaining an operation of the thumbnail picture transmission apparatus according to the second embodiment of the present invention;

25 Fig. 9 is a block diagram showing a structure of a thumbnail picture transmission apparatus according to a third embodiment of the present invention;

Fig. 10 is a flowchart for explaining an operation of the thumbnail picture transmission apparatus according to the third embodiment of the present invention;

30 Fig. 11 is a flowchart for explaining another operation of the thumbnail picture transmission apparatus according to the third embodiment of the present invention;

Fig. 12 is a block diagram showing a structure of a thumbnail picture display apparatus according to a fourth embodiment of the present invention;

Fig. 13 is a flowchart for explaining an operation of the thumbnail picture display apparatus according to the fourth embodiment of the present invention;

Fig. 14 is a diagram showing an example of thumbnail pictures displayed in the thumbnail picture display apparatus according to the fourth embodiment;

Fig. 15 is a diagram for explaining a display method of the thumbnail pictures according to the fourth embodiment;

Fig. 16 is a flowchart for explaining another operation of the thumbnail picture according to the fourth embodiment of the present invention; and

Fig. 17 is a diagram for explaining another display method of the thumbnail pictures in the thumbnail pictures display apparatus according to the fourth embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, the present invention will be described.

Turning first to Fig. 1, which is a block diagram showing a structure of a thumbnail picture transmission apparatus according to a first embodiment of the present invention. The thumbnail picture transmission apparatus 1 is an apparatus for transmitting a plurality of thumbnail pictures extracted from a picture stream to a terminal via the Internet or by broadcasting the thumbnail pictures.

As shown, the apparatus 1 includes a thumbnail picture control unit 10 for controlling an overall operation of the apparatus 1. For example, the control unit 10 is notified about a request for transmission of thumbnail pictures from a transmission request receiving unit 11, commands a thumbnail picture input unit 15 to retrieve the corresponding thumbnail pictures, requests a transmission sequence for the thumbnail pictures from a sequence determining unit 14, and instructs a thumbnail picture transmission unit 13 to transmit the thumbnail pictures.

Further, the receiving unit 11 is configured to receive a request for transmission of thumbnail pictures from any terminal connected to the apparatus 1. After receiving such a

transmission request, the receiving unit 11 notifies the control unit 10 about the transmission request.

In addition, thumbnail pictures input to the thumbnail picture input unit 15 are stored in a thumbnail picture memory unit 12, which includes a memory device such as DRAM (Dynamic Random Access Memory), for example. Further, the sequence-determining unit 14 is responsible for determining a transmission sequence of the thumbnail pictures, and the thumbnail picture transmission unit 13 is responsible for transmitting the thumbnail pictures stored in the memory unit 12 to a respective terminal requesting the pictures, according to the transmission sequence.

Turning next to Fig. 2, which is a flow chart illustrating an operation of the thumbnail picture transmission apparatus 1.

First, as shown in step S11, the receiving unit 11 receives a request for thumbnail pictures. The receiving unit 11 then notifies the control unit 10 about the transmission request (e.g., by sending a notice of receiving the request), and the thumbnail picture control unit 10 commands the input unit 15 to retrieve the requested thumbnail pictures.

Accordingly, as shown in step S12, the input unit 15 retrieves the thumbnail pictures previously extracted from a picture stream (such as the picture stream shown in Fig. 3). Note, the thumbnail pictures may be retrieved via a network connection or may be retrieved from a memory (not shown), such as HDD (Hard Disk Drive) included in the apparatus 1. After the input thumbnail pictures are retrieved, they are stored temporarily in the thumbnail picture memory unit 12 (step S13).

Fig. 3 shows an example of a picture stream from which thumbnail pictures may be extracted. Note that each of reference numerals described under the picture stream corresponds to a frame number of each thumbnail picture. Further, the thumbnail pictures in Fig. 3 are arranged in a time series, and a sequence of the frame numbers corresponds to the time series.

In addition, the picture stream is compressed according to the MPEG standard, and the thumbnail pictures in frame Nos. 1, 6, 11, 16, 21, 26, 31, 36, 41, and 46 shown by oblique lines represent I-Pictures (Intra-coding Pictures) of the MPEG standard. Further, the frame Nos. 1, 21 and 46 surrounded by black bold lines represent scene change points detected by a cut detection method (which is described in the Technology report by Electronic Information Communication Society of Japan, PRMU96-10, pp. 55-62, High-speed cut detection of

moving vector code amount from MPEG animation pictures, the entire contents of which are incorporated by reference).

A first scene in Fig. 3 includes a picture stream from frame No. 1 to frame No. 20, a second scene includes a picture stream from frame No. 21 to frame No. 45, and a third scene includes a picture stream from frame No. 45 to frame No. 50.

Further, Fig. 4 is a diagram showing the thumbnail pictures of the frame Nos. 1, 6, 11, 16, 21, 26, 31, 36, 41, and 46 in series, and which have been extracted from the picture stream in Fig. 3. Note, the thumbnail pictures shown in Fig. 4 are input to the thumbnail picture input unit 15.

Then, as shown in step S14 of Fig. 2, the thumbnail picture control unit 10 instructs the sequence-determining unit 14 to determine a transmission sequence for the thumbnail pictures. The sequence-determining unit 14 then determines a transmission sequence based on the following method.

First, the thumbnail pictures of the scene change points (frame Nos. 1, 21, 46) shown by black bold frames in Fig. 4 to be are transmitted prior to other thumbnail pictures. Further, a thumbnail picture positioned in the center of the picture stream with a longest interval between the thumbnail pictures 1, 21 and 46 is to be transmitted next. For example, an interval between frame Nos. 21 and 46 is longer than an interval between frame Nos. 1 and 21. Therefore, the thumbnail picture of frame No. 31 (or 36), which is positioned in the center of the interval between the frame Nos. 21 and 46, is to be transmitted. The second longest interval is an interval between the frame Nos. 1 and 21 is the longest. Therefore, the thumbnail picture of frame number 11 positioned in the center of an interval between the frame Nos. 1 and 21 is then to be transmitted. Hereinafter, the thumbnail pictures are similarly to be transmitted. For example, Fig. 5 is a diagram showing the thumbnail pictures rearranged in a transmission sequence based on the above determination by the sequence determining unit 14

In addition, as shown in step S15 of Fig. 2, the control unit 10 then rearranges the thumbnail pictures into the sequence determined by the sequence determining unit 14, and stores the pictures in a region of the thumbnail picture memory unit 12 as a transmission stream.

The control unit 10 also creates a table of an offset (Byte) showing a leading position of each still picture of the transmission stream and its corresponding frame number (step

S16). For example, Fig. 6 shows such a table corresponding to the transmission stream. In more detail, the 0 to 999 offset Byte of the picture stream corresponds to the thumbnail picture of frame No. 1, the 1000 to 2499 offset Byte corresponds the thumbnail picture of frame No. 21, and so on.

5 Then, the thumbnail picture control unit 10 first transfers the table and then transfers the transmission stream stored in the memory unit 12 to the thumbnail picture transmission unit 13. Next, the transmission unit 13 transmits the table and the transmission stream to the respective terminal requesting the thumbnail picture transmission (step S17).

10 As described above, the thumbnail pictures are transmitted in a predetermined sequence, which is independent of the frame sequence number. That is, picture frames corresponding to scene change points or other important points are transmitted prior to other frames. Further, the table may include a data list of the frame numbers of the transmission stream.

15 In addition, for a frame-fed display, many thumbnail pictures are necessary. Therefore, a long time is required to receive all of the thumbnail pictures via the Internet. Thus, according to the conventional method, it takes a long time to display all of the thumbnail pictures. Further, it even takes a longer time to download and display the thumbnail pictures according to the conventional method when a low bandwidth telephone line or the like is used.

20 Also, received thumbnail pictures are sequentially displayed as soon as they are received. Therefore, because the thumbnail pictures are transmitted according to the frame number sequence of the picture stream in the conventional method, the thumbnail picture of the leading frame is immediately displayed. However, it takes a long time to display the thumbnail pictures in a latter frame. Accordingly, only the thumbnail pictures near the leading frames are immediately displayed.

25 The first embodiment of the present invention is advantageous in that it solves these types of problems with the conventional method. That is, important thumbnail pictures (such as scene changes, etc.) are displayed first.

30 Turning now to Fig. 7, which is a block diagram showing a thumbnail picture transmission apparatus 2 according to a second embodiment of the present invention.

Note, the transmission apparatus 2 includes the same transmission request receiving unit 11, thumbnail picture memory unit 12, thumbnail picture transmission unit 13 and

sequence determining unit 14 illustrated in the transmission apparatus 1 shown in Fig. 1. Accordingly, a detailed description will be omitted.

The thumbnail picture transmission apparatus 2 also includes a picture stream control unit 25, which requests an extraction of an input picture stream including thumbnail pictures. The stream control unit 25 also commands a picture stream input unit 26 to send the input picture stream to a thumbnail picture extracting unit 27.

The thumbnail picture extracting unit 27 is configured to extract thumbnail pictures from the picture stream sent from the picture stream input unit 26, and to send the extracted thumbnail pictures to the memory unit 12.

An operation of the picture transmission apparatus 2 will now be described with reference to the flowchart in Fig. 8. In more detail, Fig. 8 illustrates for example an extraction operation performed on the thumbnail pictures from the input picture stream.

As shown in step S21, the transmission request receiving unit 11 first receives a transmission request for thumbnail pictures from a terminal. In this example, assume the transmission request corresponds to the thumbnail pictures in the picture stream shown in Fig. 3. The receiving unit 11 then notifies the thumbnail picture control unit 20 about receiving the transmission request. The control unit 20 next commands the picture stream control unit 25 to input the picture stream including the requested thumbnail pictures.

In response to this command, the picture stream control unit 25 transmits the input request for the picture stream to an external apparatus containing the picture stream including the requested thumbnail pictures. The picture stream input unit 26 then receives the picture stream (step S22).

Further, the picture stream input unit 26 may obtain broadcasted information transmitted in real time from an external apparatus, or may retrieve the picture stream stored in an external memory apparatus such as a server through a network. The thumbnail picture transmission apparatus 2 may also retrieve the picture stream from an internal memory apparatus such as HDD (not shown).

The picture stream retrieved by the picture stream input unit 26 is then transferred to the thumbnail picture extracting unit 27, which extracts thumbnail pictures from the picture stream (step S23). In this example, the thumbnail pictures are extracted from I-Pictures of the picture stream of Fig. 3.

The extracted thumbnail pictures are then transferred to the thumbnail picture memory unit 12, rearranged in the frame number sequence of Fig. 4, and stored in the thumbnail picture memory unit 12 (step S24).

Next, the thumbnail picture control unit 20 requests the sequence-determining unit 14 to determine the transmission sequence for the thumbnail pictures (step S25), which results in the transmitted sequence of Fig. 5.

The control unit 20 next rearranges the thumbnail pictures in the sequence determined by the sequence determining unit 14 and stores the pictures in a region of the thumbnail picture memory unit 12 as a transmission stream (step S26). The thumbnail picture control unit 20 also creates a table between an offset (Byte) showing a leading position of each thumbnail picture of the transmission stream and its frame number (step S27).

After transmitting the table to the transmission unit 13, the control unit 20 transfers the transmission stream stored in the picture memory unit 12 to the thumbnail picture transmission unit 13. Further, the thumbnail picture transmission unit 13 transmits the table and the transmission stream sent from the thumbnail picture memory unit 12 to an external apparatus such as to a terminal requesting the thumbnail picture (step S28).

As described above, after receiving the transmission request for the thumbnail pictures, the picture stream for producing the thumbnail pictures is retrieved, the thumbnail pictures are extracted from the picture stream, and the extracted thumbnail pictures are transmitted in the predetermined sequence. Therefore, a transmission independent of the frame sequence can be efficiently performed.

Turning now to Fig. 9, which is a block diagram showing a structure of a thumbnail picture transmission apparatus 3 according to a third embodiment of the present invention.

Note the transmission request receiving unit 11, the thumbnail picture memory unit 12, the thumbnail picture transmission unit 13, the sequence determining unit 14, and the thumbnail picture input unit 15 are the same as those shown in Fig. 1.

As shown, the thumbnail picture transmission apparatus 3 also includes a second thumbnail picture memory unit 36, which stores a plurality of thumbnail pictures. The second thumbnail picture memory unit 36 may include a non-volatile memory device such as HDD, DVD-RAM (Digital Video Disk-Random Access Memory), CD-RW (Compact Disk-Rewritable), and ROM (Read Only Memory), and NRAM (Magnetic Random Access Memory), or a volatile memory such as DRAM, for example.

An operation of the thumbnail picture transmission apparatus 3 will now be described with reference to the flowcharts shown in Figs. 10 and 11.

In more detail, Fig. 10 shows an operation of saving an input thumbnail picture stream in a sequence. As shown, the thumbnail picture control unit 30 first requests the thumbnail picture input unit 15 to obtain thumbnail pictures to be stored. The thumbnail picture input unit 15 then obtains the requested thumbnail pictures (step S31). In this example, the thumbnail pictures in Fig. 4 are input. Further, the input thumbnail pictures are temporarily stored in the first thumbnail picture memory unit 12 (step S32).

The control unit 30 then requests the sequence-determining unit 14 to determine the transmission sequence for the input thumbnail pictures. The sequence-determining unit 14 then determines the transmission sequence (step S33). In this example, the determined transmission sequence is same as that shown in Fig. 5.

The picture control unit 30 then rearranges the thumbnail pictures in the sequence determined by the sequence determining unit 14 and stores the pictures in a region of the first thumbnail picture memory unit 12 as a transmission stream (step S34). Further, the thumbnail picture control unit 30 creates a table between an offset showing a leading position of each thumbnail picture of the transmission stream and a frame number (step S35). The thumbnail picture control unit 30 then saves the table and the thumbnail picture stream stored in the first thumbnail picture memory unit 12 into the second thumbnail picture memory unit 36 (step S36).

Turning next to Fig. 11, which is a flow chart showing an operation for the transmission of the stream stored in the second thumbnail picture memory unit 36.

In more detail, the receiving unit 11 receives a transmission request for the thumbnail pictures (step S37). In this example, the requested transmission is for the thumbnail pictures in the picture stream in Fig. 3. The receiving unit 11 then notifies the thumbnail picture control unit 30 about the transmission request.

The thumbnail pictures corresponding to the transmission request are stored in the second thumbnail picture memory unit 36 as a stream obtained by the steps in the flow chart of Fig. 10. The thumbnail picture control unit 30 then transfers the table and the transmission stream stored in the second thumbnail picture memory unit 36 to the thumbnail picture transmission unit 13 (step S38). After transmitting the table sent from the second thumbnail

picture memory unit 36, the transmission unit 13 then transmits the stored table transmission stream to an external apparatus requesting the thumbnail pictures (step S39).

As described above, after the thumbnail pictures are input, the thumbnail pictures are stored in the predetermined sequence, and the stored transmission stream is transmitted upon receiving the transmission request for the thumbnail pictures. Therefore, a transmission independent of a frame sequence number can be efficiently performed.

Turning now to Fig. 12, which is a block diagram showing a structure of a thumbnail picture display apparatus 4 according to a fourth embodiment of the present invention.

The display apparatus 4 includes a frame-feed function for frame-feed displaying thumbnail pictures at regular or irregular intervals. The frame-feed display 4 in this example sequentially displays thumbnail pictures at intervals of 0.5 sec. in order from a small to large frame number.

As shown, the thumbnail display apparatus 4 includes a thumbnail picture control unit 40, which requests a thumbnail picture receiving unit 44 to receive thumbnail pictures, controls the thumbnail pictures stored in a thumbnail picture memory unit 42, and requests the thumbnail picture display unit 43 to frame-feed display the thumbnail pictures.

In more detail, a user input unit 41 receives a request for displaying thumbnail pictures from a user. The user input unit 41 then sends the display request to the thumbnail picture control unit 40. Further, the thumbnail picture memory unit 42 (e.g., a memory device such as a DRAM or HDD) stores the received thumbnail pictures. The thumbnail picture display unit 43 may then display the thumbnail pictures stored in the thumbnail picture memory unit 42. In addition, the thumbnail picture receiving unit 44 receives the thumbnail pictures via the Internet or by broadcasting, and the received thumbnail pictures are stored in the thumbnail picture memory unit 42.

An operation of the thumbnail picture display apparatus 4 will now be described with reference to a flowchart of Fig. 13.

As shown, the user input unit 41 first receives a request for a frame-feed display of thumbnail pictures from a user (step S41). The user input unit 41 then notifies the thumbnail picture control unit 40 about the request, and the control unit 40 begins a frame-feeding display process based on the received table corresponding to thumbnail pictures sequence (step S42).

The control unit 40 also checks whether or not the requested thumbnail pictures to be displayed are stored in the thumbnail picture memory unit 42 (step S43).

Fig. 14 shows an example of still pictures of the thumbnail pictures for the frame-feed display. Note the reference numerals in Fig. 14 represent frame numbers, and the thumbnail pictures corresponding to frame Nos. 1, 21, 31 and 46 shown by oblique lines are received by the thumbnail picture receiving unit 44 and stored in the thumbnail picture memory unit 42.

The control unit 40 first checks whether or not the still picture corresponding to frame No. 1 is stored in the thumbnail picture memory unit 42. Because in this example the thumbnail picture of frame No. 1 is stored in the memory unit 42, the thumbnail picture is transferred to the display unit 43, which then displays the thumbnail picture of frame No. 1 for 0.5 sec. (Step S44).

After the thumbnail picture of frame No. 1 is transferred to the thumbnail picture display unit 43, the control unit 40 checks whether or not the thumbnail picture of frame No. 6 is stored in the thumbnail picture memory unit 42. However, because in this example the frame No. 6 thumbnail picture is not stored in the memory unit 42, the control unit 40 selects another thumbnail picture closest to frame No. 6 from the thumbnail pictures stored in the memory unit 42 (step S45). In this example, the thumbnail picture of frame No. 1 is closest to frame No. 6. The control unit 40 then transfers the thumbnail picture of No. 1 to the thumbnail picture display unit 43, which displays the frame No. 1 thumbnail picture for 0.5 sec. (step S46).

The thumbnail pictures are then sequentially transferred to the thumbnail picture display unit 43 in a similar fashion as described above, and the display unit 43 displays each of these thumbnail pictures respectively for 0.5 sec.

For example, Fig. 15 is a diagram showing a row of thumbnail pictures displayed at intervals of 0.5 sec. by the display unit 43. The thumbnail picture in frame No. 1 is displayed for 1.5 sec., the thumbnail picture in frame No. 21 is displayed for 1.5 sec., the thumbnail picture in frame No. 31 is displayed for 1.0 sec., and the thumbnail picture in frame No. 46 is displayed for 1.0 sec.

As described above, in place of the non-stored thumbnail pictures, a stored thumbnail picture in a frame number closest to the non-stored still picture is selected from the stored thumbnail pictures and is displayed, whereby the frame-feed display can be performed using the stored thumbnail pictures.

Further, using the different thumbnail picture transmission apparatus described above, the frame-feed display can be efficiently performed. Also, even with a method in which the important still pictures corresponding to the scene change points are transmitted first, the sufficient effect can be obtained.

Another operation of the thumbnail picture display apparatus 4 will now be described with reference to the flowchart shown in Fig. 16.

As shown, the user input unit 41 first receives a request for frame-feed display of thumbnail pictures from a user (step S51).

The user input unit 41 then notifies the thumbnail picture control unit 40, which checks whether or not the requested thumbnail pictures are stored in the thumbnail picture memory unit 42 (step S52).

In this example, the thumbnail pictures in frame Nos. 1, 21, 31 and 46 shown by oblique lines of Fig. 14 are stored in the thumbnail picture memory unit 42. The control unit 40 then requests the receiving unit 44 to request the thumbnail pictures corresponding to frame Nos. 6, 11, 16, 26, 36, and 41, which have not been stored in the memory 42. The receiving unit 44 next sends this transmission request to any one of the transmission apparatus described in the above embodiments (step S53).

The thumbnail pictures received in accordance with the transmission request are then stored in the thumbnail picture memory unit 42 and the frame-feed display of the pictures is started (step S54). That is, as shown in step S55, the control unit 40 checks whether or not a thumbnail picture in frame No. 1 is stored in the memory unit 42.

Because the thumbnail picture in frame No. 1 is stored in the thumbnail picture memory unit 42, the stored thumbnail picture is transferred to the thumbnail picture display unit 43, which displays it for 0.5 sec. (step S56).

Next, the control unit 40 checks whether or not a thumbnail picture corresponding to frame No. 6 is stored in the thumbnail picture memory unit 42. While the thumbnail picture corresponding to frame No. 1 is displayed for 0.5 sec., in case the thumbnail picture in frame No. 6 is received by the receiving unit 44 and is stored in the memory unit 42, the thumbnail picture in frame No. 6 is sent to the picture display unit 43. The display unit 43 then displays the thumbnail picture for 0.5 sec. However, if the picture in frame No. 6 is not received by the receiving unit 44, the control unit 40 selects a thumbnail picture in a frame closest to the

frame No. 6 from the thumbnail pictures stored in the thumbnail picture memory unit 42 (step S57).

In this example, the thumbnail picture of frame No. 1 is closest to that of frame No. 6 among the pictures stored in the memory unit 42. Next, the control unit 40 sends the thumbnail picture in frame No. 1 to the picture display unit 43, which displays the thumbnail picture for 0.5 sec. (step S58).

The thumbnail pictures are then sequentially transferred to the thumbnail picture display unit 43 in a similar fashion as described above, and the display unit 43 displays each of these thumbnail pictures respectively for 0.5 sec.

For example, Fig. 17 is a diagram showing a row of pictures displayed in the thumbnail picture display unit 43 at intervals of 0.5 sec. As shown in Fig. 17, because pictures in frame Nos. 6, 11, 16 and 26 have not been received by the receiving unit 44 and are not stored in the memory unit 42 at the frame-feed displaying time, the pictures in frame Nos. 1 and 21 are respectively displayed.

Further, because pictures in frame Nos. 36 and 41 have been already received by the receiving unit 44 and are stored in the memory unit 42 at the frame-feed displaying time, the stored pictures in frame Nos. 36 and 41 are displayed in the display unit 43.

As described above, if requested pictures have not been received by the time of the frame-feed display, other thumbnail pictures in the frame numbers closest to the non-stored still pictures are selected and displayed. Therefore, the frame-feed display of thumbnail pictures can be performed using the stored pictures.

Further, the thumbnail pictures display apparatus can be used in combination with the thumbnail picture transmission apparatus in any of one of the first to third embodiments discussed above. The components of the different thumbnail picture transmission apparatuses may also be suitably combined and used.

In addition, the functions of the thumbnail picture transmission apparatus and display can be performed by a computer program, and the functions described in the embodiments can be performed by using program products for thumbnail pictures transmission or program products for thumbnail pictures display, which causes the computer to execute these functions.

Further, by recording the program products for thumbnail picture transmission and display in a computer-readable recording medium, the same effects as those of the above

embodiments can be readily obtained by inputting the computer program in a computer through the recording medium.

That is, this invention may be conveniently implemented using a conventional general purpose digital computer or microprocessor programmed according to the teachings of the present specification, as will be apparent to those skilled in the computer art. Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those skilled in the software art. The invention may also be implemented by the preparation of application specific integrated circuits or by interconnecting an appropriate network of conventional component circuits, as will be readily apparent to those skilled in the art.

The present invention also includes a computer program product which is a storage medium including instructions which can be used to program a computer to perform a process of the invention. The storage medium can include, but is not limited to, an type of disk including floppy disks, optical disks, CD-ROMs, and magneto-optical disks, ROMs, RAMs, EPROMs, EEPROMs, magnetic or optical cards, or any type of pure software inventions (e.g., word processing, accounting, Internet related, etc.) media suitable for storing electronic instructions.

In addition, the above-described embodiments refer to compressed still pictures (i.e., thumbnail pictures). However, the pictures used in the frame-feed display do not always have to be compressed (i.e., non-compressed pictures may be substituted for the thumbnail pictures in the above embodiments).

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.